RAPID RIVER FISH HATCHERY

1988 Chinook Brood Year Report

by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF APPENDICES (cont.)

ABSTRACT

The Rapid River adult trap was in operation from April 14 through September 15, 1988. During this time 3,780 spring chinook salmon Oncorhynchus tshawytscha were collected. This total was comprised of 3,608 adults and 172 jacks. Incidental trapped summer chinook salmon totaling 102 adults and 13 jacks were released back into Rapid River adjacent to the hatchery complex. Additionally, there were 90 adult steelhead Oncorhynchus mykiss trapped, of which 5 were of hatchery origin and 85 were of wild origin. This year, because of the small return of Hells Canyon fish (393, of which 12 were jacks), it was decided to combine these fish with the Rapid River returns.

Overall, prespawning mortality averaged 18.9% (788 fish). Spawning operations began on August 15 and continued through September 9, 1988. A total of 1,645 females were spawned, having an average fecundity of 4,879 eggs per female. These fish yielded 7,905,702 eggs, of which 1,475,677 were given to the Oregon Department of Fish and Game. Survival to eye-up and swim-up was 90.68% and 89.74%, respectively.

Approximately 5.7 million swim-up fry were transferred to the raceways for early rearing during the period December 20, 1988 through March 1, 1989. Final rearing culminated with 2,520,400 smolts planted in Rapid River, 551,200 in the Snake River below Hells Canyon Dam, and 250,000 in the Little Salmon River. Prior to smolt release 391,886 fish were coded wire tagged.

Overall feed conversion for 1988 brood year fish was 1.69. The cost per pound of 1988 brood year smolts released was $3.69 ($0.138 per smolt released).

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INTRODUCTION

Rapid River Hatchery was constructed in 1964 by the Idaho Power Company (IPC) as compensation for losses of chinook salmon resulting from the construction of Brownlee, Oxbow, and Hells Canyon dams on the Snake River. Mitigation, as required by the Federal Energy Regulatory Commission, required that IPC transplant the run of chinook salmon from the Snake River to the Salmon River drainage and to provide funds for the production of 3 million spring chinook salmon smolts annually. These fish are designated for release into Rapid River and the Snake River below Hells Canyon Dam.

LOCATION

Rapid River Hatchery is located in Idaho County, Approximately 7 mi (11.2 km) southwest of the community of Riggins, Idaho, on Rapid River - a tributary of the Little Salmon River. Rapid River Hatchery is staffed and operated by the Idaho Department of Fish and Game (IDFG) and completely funded by IPC.

OBJECTIVES

The objectives of Rapid River Hatchery are:

1. To produce 3 million spring chinook salmon smolts at an average size of approximately 20 fish/lb (44.1 per kg) for release into Rapid River and Snake River below Hells Canyon Dam.

2. To trap and spawn adult spring chinook salmon returning to Rapid River.

3. To evaluate various strategies and techniques for rearing spring chinook salmon.

4. To provide eggs and/or fry for supplementation purposes.

FISH REARING/HOLDING FACILITIES

Fish rearing facilities at Rapid River Hatchery consists of 50 double stack Heath incubator trays, 12 outdoor concrete raceways (6 ft x 90 ft), and two earthen rearing ponds with concrete side walls; Pond 1AB (84 ft x 199 ft), Pond 2AB (36 ft x 371 ft), and Pond 2CD (36 ft x 371 ft). One concrete adult holding pond (80 ft x 25 ft) and two earthen holding ponds, Adult Pond No. 2 (40 ft x 150 ft) and Adult Pond No.3 (80 ft x 250 ft), provide space for holding up to 10,000 adult salmon for spawning, (Table 1 and 2).

Table 1. Rapid River Hatchery production capacity data.

Rearing/Holding area	Volume	Carrying capacity
Heath incubators	768 Trays	7.7 million eggs
Raceways (12)	1,890 cu. ft. (ea)	500,000 fry
Rearing Pond No. 1	57,600 cu. ft.	1 million smolts
Rearing Pond No. 2	82,000 cu. ft.	2 million smolts
Adult Pond No. 1	12,000 cu. ft.	1,000 adults
Adult Pond No. 2	24,000 cu ft.	3,000 adults
Adult Pond No. 3	80,000 cu. ft	6,000 adults

Table 2. Rapid River rearing/holding area volumes.

Rearing/Holding area	Volume
Rearing Pond No. 1A	28,800 cu.ft.
Rearing Pond No. 1B	28,800 cu.ft.
Rearing Pond No. 2A	21,700 cu.ft.
Rearing Pond No. 2B	19,300 cu.ft.
Rearing Pond No. 2C	19,300 cu.ft.
Rearing Pond No. 2D	21,700 cu.ft.
Adult Pond No. 1	12,000 cu.ft.
Adult Pond No. 2	24,000 cu.ft.
Adult Pond No. 3	80,000 cu.ft.

The adult trapping facility, located on Rapid River approximately 1.5 mi (2.4 km) downstream from the hatchery, is equipped with a permanent wooden velocity barrier, a three-step fish ladder, and a two-stage trap. Adult salmon are transferred from the trap to a 1,000-gal tank truck for transport to the hatchery by means of an Alaska Steep Pass ladder and a 500-gal bucket operated by an overhead hoist.

WATER SUPPLY

From its origin in Adams County, Rapid River flows through a pristine canyon before reaching the hatchery. Under inclusion in the Wild and Scenic Rivers Act, the Rapid River drainage has not been subject to perturbations, such as logging and road building, and, consequently, provides an excellent water source for rearing chinook salmon. Water quality parameters are listed in Table 3.

Table 3. Water Quality Analysis, Rapid River, March 1989.

Parameter	Suggested range	Observed level
Alkalinity as CaCO3	10-400	62.0
Dissolved Oxygen	5.0-saturation	13.0
Ammonia (NH3)	<0.0125	0.003
pH	6.5-8.0	7.3
Total Hardness as CaCo3	10-400	74.0

Hatchery water is obtained through one 30-in (76.2 cm) and one 24-in (61.0 cm) pipelines. A 5-ft (1.5 m) high wooden diversion dam provides the necessary hydraulic head to supply the hatchery with approximately 30 ft /s (CFS) of water. Except for the incubators, all systems operate on gravitational flow. Water for the incubation system is pumped from the headrace by one of two 7.5-horsepower electric pumps. A gasoline operated backup pump and a filter bed system provide water during electrical failures.

STAFFING

The permanent hatchery staff consists of a Hatchery Superintendent III, a Hatchery Superintendent I, and a Fish Culturist. Approximately five seasonal employees are hired each year from February through November. The summer Youth Employee Training Program also provides one or two employees to assist with grounds *maintenance,* etc. Housing accommodations include three residences for the permanent staff and a mobile home for the seasonal employees.

ADULT COLLECTION

Spring Chinook Salmon Returns To Rapid River

The adult trapping facility was in operation from April 14 through September 15, 1988. Spring chinook salmon totaling 3,780 (3,608 adults and 172 jacks) were collected between May 9 and August 12, 1988, with the peak of the run occurring June 8-15, 1988 (Figure 1).

The sex composition ratio of the run (including Hells Canyon returns) was composed of 1,745 adult males, 2,244 females, and 184 jacks. Age composition, determined by fork length measurement (Figure 2) indicated 184 (4.4%) three year olds, 1,880 (45.1%) four year olds, and 2,109 (50.5%) five year olds.

All spring chinook salmon, *including* jacks, were given a single, subcutaneous injection of water soluble, Erythromycin Phosphate, at the rate of 5 mg active Erythromycin per pound of fish. Powdered Erythromycin Phosphate (80% active) was used this year to make the injectable stock solution. All spring chinook salmon were transported to the hatchery after being injected, checked for injuries, and measured to the nearest centimeter fork length.

Throughout the trapping period injuries totaling 636 were documented. These injuries were comprised of 137 gaff wounds, 228 *nitrogen* burns, 78 gill net scars, and 193 injuries of unknown origin. Trapping/handling mortalities totaled 11 adults and 1 jack (6 adult males, 5 females, and 1 jack).

Snouts from 423 coded-wire-tagged (CWT) fish were collected and sent to Lewiston this year. CWTs were found in 11 of the jacks, 298 of the four year olds, and 114 the five year olds. These fish were tagged as part of the U.S./Canada agreement to determine Idaho's *contribution* to the ocean harvest.

Hells Cannon Spring Chinook Salmon

Spring chinook salmon totaling 381 adults and 12 jacks were transferred to Rapid River Hatchery from the IPC, Oxbow/Hells *Canyon* project. At the time of ponding *in* the HP-2 *pond,* neither of the runs of fish had developed enough secondary sexual characteristics to distinguish between males and females.

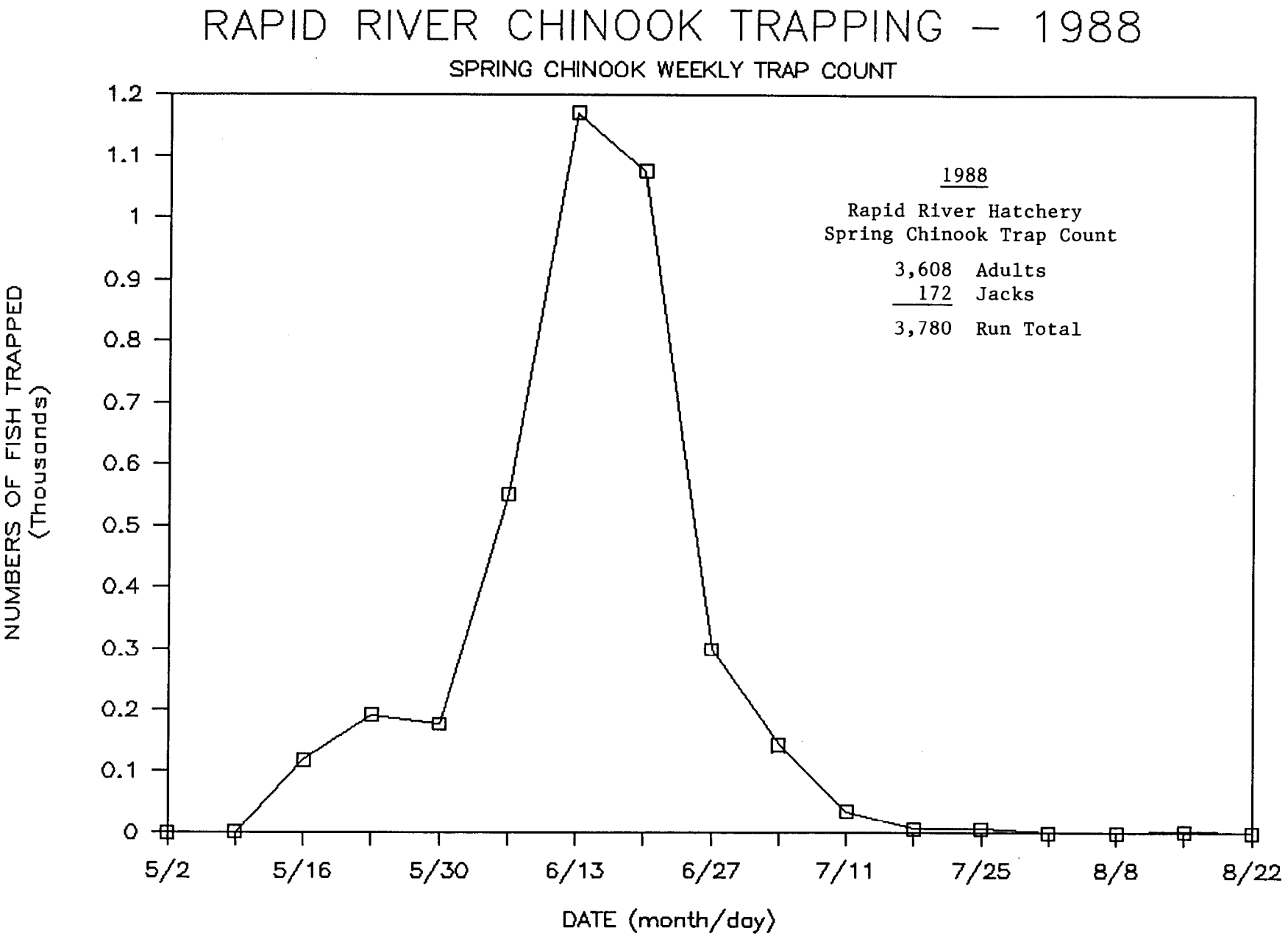
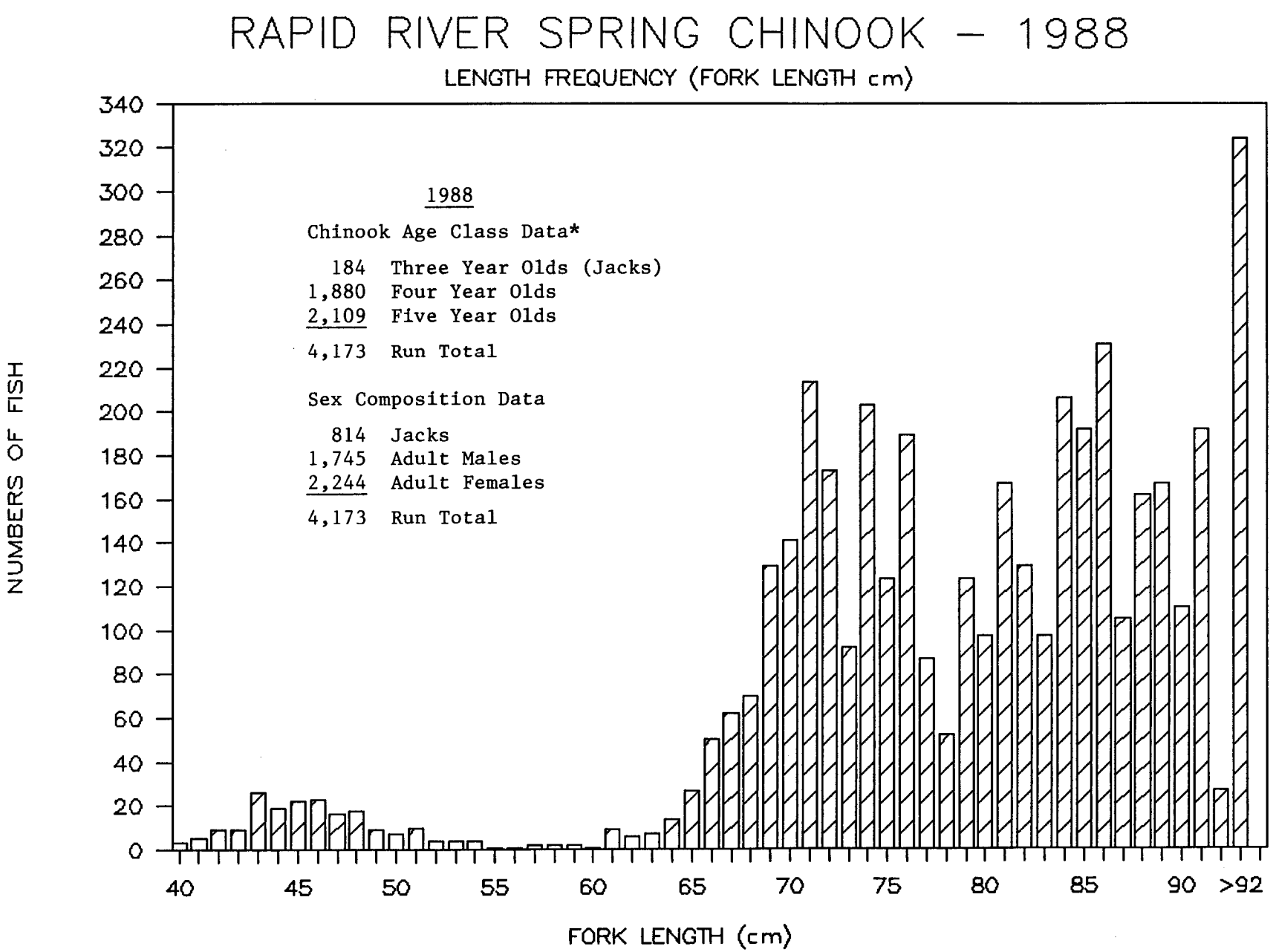


Figure 1. Run timing of spring chinook salmon returns to Rapid River, 1988.



* Age determination through length frequency (see Appendix 6)

Figure 2. Spring chinook salmon length frequency, 1988.

Other specific data pertaining to run timing, injuries, length frequency, etc. is available in the annual report from the Oxbow Fish Hatchery.

Inventory of Miscellaneous Species

All salmon entering the trap after July 8, 1988, were classified as summer chinook salmon except adipose clipped fish. A total of 115 summer chinook salmon entered the Rapid River trap from July 8 through September 1, 1988 (Table 4). The sex composition ratio of these fish was: 49 adult males, 53 females, and 13 jacks. All summer chinook salmon were transported from the trap facility and released in Rapid River adjacent to the hatchery complex. Length frequency information for the summer chinook salmon trapped is depicted in Figure 3.

Other species trapped this season included 136 bull trout Salvelinus confluentus, 5 whitefish Prosopium williamsoni, and 90 adult steelhead. The steelhead count was comprised of 4 males and 1 female of hatchery origin, and 25 males and 60 females of wild origin (Table 5). All hatchery fish were transported to the Little Salmon River and released approximately 1 mi above the confluence of Rapid River. All wild steelhead were transported and released into Rapid River adjacent to the hatchery complex. Steelhead length frequency data is listed in Table 5.

Table 4. Inventory of miscellaneous species.

Species	Number trapped
Summer chinook salmon	115
Steelhead *	90
Bull Trout	136
Whitefish	5

* Specific data listed in Table 5.

HARVEST DATA/SPORT AND INDIAN FISHERY

During 1988, it was estimated that 692 spring chinook salmon were harvested by the sport fishery on the Little Salmon River. Harvest data reported by the Nez Perce Tribe indicated an additional 3,520 fish were taken by the indian fishery.

PRESPAWNING MORTALITY

A total of 4,161 spring chinook salmon (excluding 12 trap morts) were held at Rapid River Hatchery this year. Approximately, 2,679 spring chinook salmon were held in the HP-2 pond. Another 1,032 fish were held in the HP-1 pond, and the balance, 450 fish, were held in the HP-3 pond.

Prespawning mortality in all ponds was 788 fish (18.9% of the total). BKD lesions were visible in 56 of these fish (7.1% of the prespawning mortalities). The prespawning loss sex ratio included 206 males and 540 females from the Rapid River returns. Hells Canyon returning fish mortalities consisted of 20 males and 22 females totaling 42 fish (11.2% of the Hells Canyon returns). Treatments with malachite green at the rate of 1 ppm, 3 d/week, were initiated on the HP-2 system

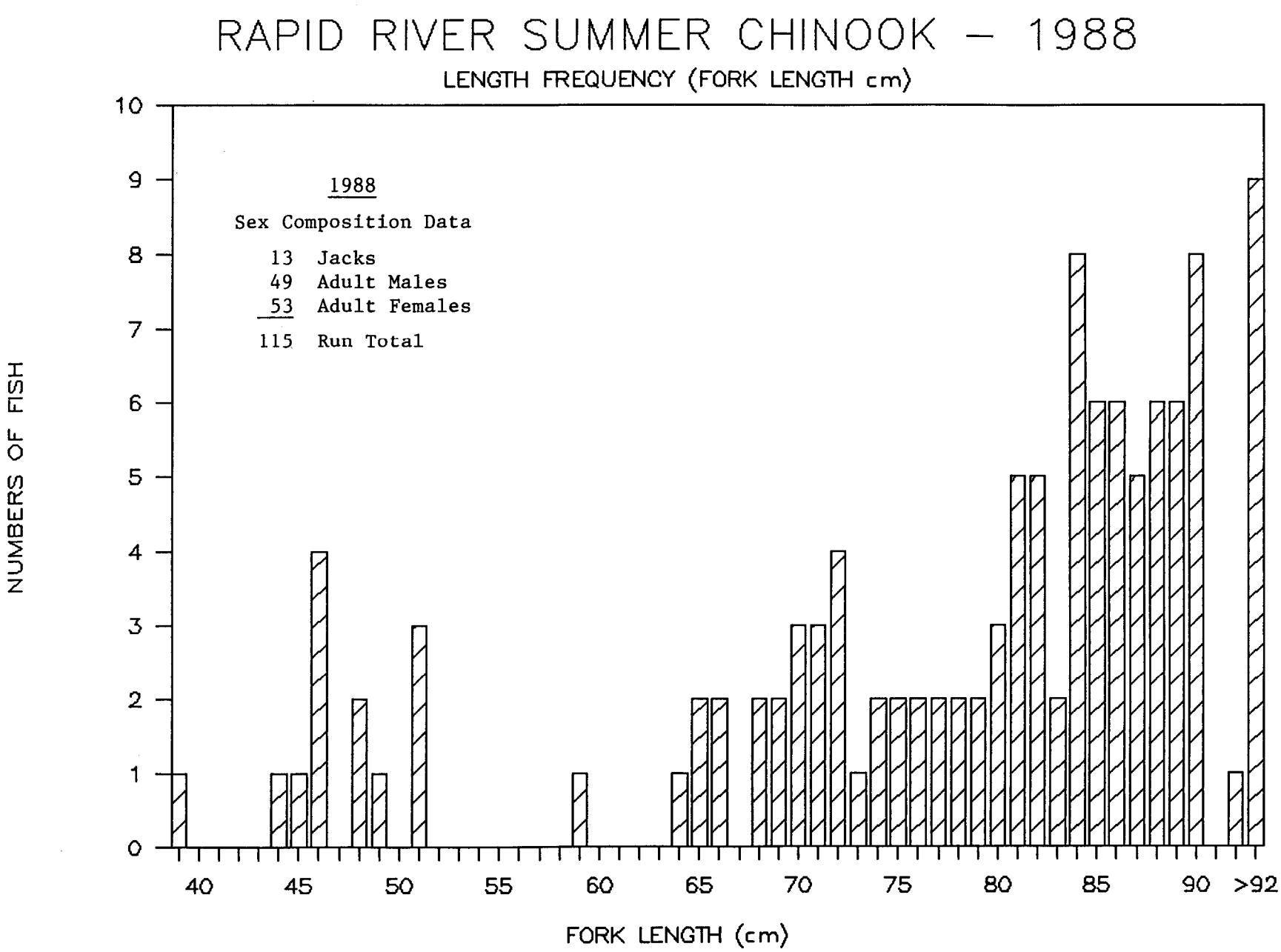


Figure 3. Summer chinook salmon length frequency, 1988.

Table 5. Rapid River adult steelhead length frequency data, 1988.

Length (cm)	Hatchery origin		Wild origin	
	Males	Females	Males	Females
55				1
56				1
57				1
58			1	
59	2		1	
60				
61			1	2
62				
63	1		3	
64			5	1
65			1	1
66			5	4
67				
68			1	2
69		1	1	3
70				4
71			1	6
72				2
73				4
74				8
75			1	5
76	1			3
77				3
78				3
79			2	1
80				1
81				
82			1	1
83				
84				
85			1	
86				
87				
88				
89				
Totals	4	1	25	60

on May 23, HP-1 system on June 20, and on the HP-3 system on June 28, 1988. The treatments were very effective in reducing fungus problems.

CHINOOK SALMON SPAWNING

Spawning operations began on August 15 and continued 2 d/week through September 9, 1988. Rapid River returning fish were combined both with those from Hells Canyon, so there is no differentiation between the spawning operations. A total of 1,645 females were spawned to produce approximately 7,905,702 eggs which exhibited an average eye-up of 90.68% (Table 6). At this time, 1,475,677 eyed eggs were transferred to the Oregon Department of Fish and Game (Looking Glass Hatchery). Forty-six females were destroyed prior to spawning due to poor egg quality, bloody ovarian fluid, symptoms of BKD, etc.

Spawning protocol used in 1988 included placing eggs from two females into a colander to drain off the ovarian fluid. Eggs were transferred to a bucket, fertilized with milt from two males and mixed with approximately 1 cup of well water to activate the sperm. A random selection of jacks, representing 1-2% of the males, were used to fertilize the eggs. Each bucket of eggs were water hardened for 30 minutes in a 200 ppm stock solution of buffered Argentyne. Heath vertical stack incubators were used for incubation.

CARCASS DISPOSITION

During 1988, all non-salvageable carcasses from spawning and daily mortalities were collected twice a week and hauled to a landfill near Grangeville, Idaho, by the Walco Company. One salvageable chinook salmon carcass was dressed, frozen, and given to IDFG Conservation Officer Mark Taylor for a picnic for the North Idaho Children's Home and Latah Care Center.

EGG INCUBATION

Beginning on the fourth day of incubation, all egg lots were treated with formalin to retard fungal development. Treatments were administered three times per week at a 1:600 concentration for 15 min and continued until each egg Lot accumulated 800 temperature units (T.U.'s).

Eye-up occurred at approximately 500 T.U.'s at which time all eggs were shocked and picked using the salt flotation method. The volumetric displacement method was then used to calculate egg size and numbers (Table 6).

Hatching occurred at approximately 1,000 T.U.'s at which time all egg Lots were "secondary" picked. Swim-up fry were transferred to the early rearing raceways at 1,700 to 1,900 T.U.'s. Survival from eyed eggs to swim-up fry averaged 89.74% (Table 7).

Table 6. Spring chinook salmon egg take information, Brood Year 1988.

Lot number	Date spawned	Number females	Number green eggs	Average eggs per female	Number eyed	Percent eye-up	Second pick	Eggs/Fry remaining
1	8/15	14	66,053	4,718	60,964	92.30	962	60,002
2	8/16	16	78,342	4,896	67,180	85.75	3,527	63,653
3	8/22	51	262,720	5,141	234,875	89.40	1,679	233,196
4	8/23	195	965,609	4,952	872,085	90.31	7,718	864,367
5	8/25	72	349,837	4,859	315,155	90.09	6,886	308,269
6	8/26	230	1,133,572	4,929	1,044,243	92.12	8,849	1,035,3
7*	8/30	204	1,005,494	4,929	889,925	88.51	10,069	879,856
8	8/31	215	1,061,134	4,936	970,883	91.49	8,698	962,185
9	9/02	170	814,637	4,792	738,681	90.68	6,360	732,321
10	9/06	132	616,011	4,667	566,651	91.99	3,734	562,917
11	9/09	14	52,293	3,735	47,900	91.60	1,300	46,600
Totals		1,313	6,405,702	4,879	5,808,542	90.68	59,782	5,748,760

* This number does not include 1,475,677 eggs (from 332 females) shipped to Oregon from Lot 7. The actual Number of green eggs kept at Rapid River Hatchery was 6,405,702.

Table 7. Survival from green eggs to swim-up fry, Brood Year 1988.

Rapid River and Hells Canyon Returns Combined				
Eggs taken	Eyed eggs	Percent Eye-up	Swim-up fry	% Survival to swim-up
6,405,702	5,808,542	90.68	5,748,760	89.74

Note: Numbers do not include 1,475,677 eyed eggs from 332 females shipped to Oregon's Looking Glass Hatchery.

FISH PRODUCTION

Early Rearing

During the period of December 20, 1988 through March 1, 1989, a total of 5,748,760 fry were transferred to the raceways. Average size at the time of transfer was 1,300 fish/lb. Loading densities ranged from 402,191-572,465 fish per raceway, with an initial water depth of 1.5 ft and water inflow of 0.9 CFS. As fish size increased, water depth and flow were adjusted to a maximum depth of 3 ft and flow of 1.5 CFS per raceway. Density and flow indices were kept below 0.5 and 1.5, respectively, throughout the initial rearing period. Fry size increased to an average length of 2.38 in for a conversion of 1.03 during the raceway rearing period.

Wooden baffle boards were placed in Raceway No.6 on March 22, 1989, with a 4-in slot along the bottom to aid in moving sand and detritus through the raceway. New aluminum baffles were built for two raceways at the Idaho Power Company shop and installed in raceways 7 and 8. These baffles worked well and had a cleaner, more professional appearance than the plywood baffles made here at the hatchery.

Final Rearing

Brood year 1988 fingerlings, totaling 3,370,944 fish, were transferred from the raceways to the final rearing ponds from May 9 through June 9, 1989. Initial pond loadings are presented in Table 8.

During final rearing only BioProducts feed was used (Appendix 3). Through the 1987 Brood Year, a comparison test was done which involved both Moore Clark and BioProducts, to find out which feed performed better, resulting in better fish growth, feed conversion, and reduced mortality. After November 1, 1988, all fish were fed the BioProducts diet.

Table 8. Initial pond loading densities, June 1989.

Pond	Inflow	Millions of fish	Number per pound	Density index	Flow index
1	14.1 cfs	1.2	94.67	.07	.73
2A	4.8 cfs	.3	118.32	.04	.42
2B	4.8 cfs	.5	128.80	.08	.75
2C	4.8 cfs	.5	117.36	.08	.77
2D	4.8 cfs	.7	90.10	.04	1.16

Feed Use and Conversion Data

A total of 222,134 lb of BioProducts feed was used for the 1988 brood year fish and fingerling outplants. This total is comprised of 36,250 lb of Erythromycin medicated feed and 185,884 lb of standard feed. Specific data on feed types and sizes used are listed in Appendix 3. The overall feed conversion for 1988 brood year fish was 1.69.

Total costs paid by IPC to operate Rapid River Hatchery during the period September 1, 1989 through March 31, 1990 was approximately $459,450. These costs include: fish feed, smolt transportation and marking, hatchery personnel salaries, and operation and maintenance costs. No capital outlay expenditures are included in this total. The resulting cost per pound of 1988 brood year smolts produced at Rapid River Hatchery was $3.69/lb ($0.138 per smolt released).

FISH HEALTH

Brood Stock

Although overall fish health problems were minimal during 1988, prespawning mortality averaged nearly 19%. A contributing factor may have been the use of Benzalkonium Chloride (BC) which was being used as a treatment for Bacterial Gill Disease while rearing spring chinook salmon. The effluent water from this rearing pond is also utilized by the adult holding pond. The synergistic effect of BC and the fungicide malachite green could have been a problem.

Routine sampling was conducted by IDFG pathology staff throughout the holding and spawning period. Necropsies revealed no evidence of whirling disease, EIBS, or IPN virus. Visible signs of BKD were observed this season in approximately 7% of all prespawning mortalities.

Adult fungal problems were minimal during 1988 with adequate control attained with 1 ppm treatments of malachite green, 3 d/week.

Production Fish

A minimal number of moribund fry were observed in the raceways in December 1988 and January 1989. Hatchery staff observed a "whirling" behavior and contacted the Eagle Fish Health Lab personnel. Histology and virology tests were run on moribund fish. The sample taken on December 19 had areas of focal necrosis in the midbrain, but no virus was isolated. A second sample taken on January 16 revealed no abnormalities. There were no other major problems encountered during early rearing.

Mortality levels due to EIBS were severely reduced in the brood year 1988 fish. Brood year 1987 fish had 12.18% (391,133 fish) mortality during final rearing compared to 1.9% (64,563 fish) for brood year 1988 fish. Mortalities in Pond 1 fish accounted for 66.58% of the total 1988 brood year mortalities (42,990 fish). Reduced mortality was possibly attributed to the fact that BioProducts feed was used for this entire brood year. BioProduct feed had higher levels of vitamin C, B-12, and folic acid, as compared to feed used in past years from the Moore-Clark Co.

During final rearing, the pathology staff tested for EIBS six times. The samples were taken on June 27, August 29, September 14, October 11, December 12, and February 16. The first positive samples were found on September 14 when 1 fish of 36 tested (2.77%) was found to be infected. The October 11 tests revealed 11 of 42 fish tested (26.19%) were positive. On December 12, tests showed 18 of 60 fish tested (30.00%) were found positive. The final pre-release sample was taken from each pond and tests were run separately to see how infection rates varied between Pond 1 and Pond 2. Pond 2 was negative in all sections, but Pond 1 had 4/15 fish (26.67%) EIBS positive at release time.

FISH MARKING/CWT DATA

A portion of the 1988 brood inventory was marked October 25 through November 3, 1989 in accordance with the U.S./Canada treaty. These fish will serve as one of the indicators of Idaho's contribution to the ocean harvest. CWTs and some freeze brands were used during this project. Specific tag/release data is presented in Table 9.

FISH DISTRIBUTION

Fingerling Releases

During May and June 1989, approximately 1.6 million fingerlings surplus to Rapid River Hatchery were outplanted to the Clearwater River and Salmon River tributaries. Specific plant data is presented in Table 10.

Smolt Releases

Volitional smolt releases from Rapid River Hatchery began on March 12, 1990, at which time most fish averaged 27 fish/lb (Table 11). Between March 12 and March 26, it was estimated, by visual observation, that approximately 400,000 fish had migrated out of the rearing ponds.

Table 9. Marking/Release summary, Brood Year 1988.

Date released	Tag type	Tag code	Tags released	Site released
03/22-26/90	CWT	10/32/13	55,100	Rapid River
03/22-26/90	CWT	10/32/14	53,850	Rapid River
03/22-26/90	CWT	10/32/15	55,725	Rapid River
03/22-26/90	CWT	10/32/16	55,336	Rapid River
03/22-26/90	CWT	10/32/17	56,025	Rapid River
03/22-26/90	CWT	10/32/18	55,100	Rapid River
03/22-26/90	FB	RAT-1	20,600	Rapid River
03/22-26/90	FB	RAT-2	20,175	Rapid River
03/22-26/90	FB	RAT-3	19,975	Rapid River
Totals			391,886	

Table 10. Fingerling releases, Brood Year 1988.

Date	Plant site	Number planted	Fish/lb.	Total length (in)
Salmon River Drainage				
05/25/89	L. Salmon R.	149,570	268	2.28
05/25/89	L. Salmon R.	149,570	268	2.44
Subtotal		299,140		
Clearwater River Drainage				
05/30/89	Ten Mile Creek	100,278	250	2.52
06/07/89	Crooked River	101,062	193	2.76
06/09/89	Crooked River	100,862	200	2.72
06/13/89	Newsome Creek	100,628	169	2.87
06/13/89	Boulder Creek	100,299	169	2.83
06/13/89	Boulder Creek	100,342	169	2.83
06/14/89	Newsome Creek	100,097	169	2.83
06/15/89	Brushy Fork	195,398	183	2.76
06/20/89	White Sands Creek	99,919	183	2.76
06/21/89	White Sands Creek	100,148	183	2.76
06/22/89	American River	99,401	183	2.76
06/26/89	American River	51,369	183	2.76
06/26/89	Meadow Creek	39,163	183	2.76
Subtotal		1,288,966		
Total Fingerling Plants:		1,588,106		

Table 11. Rearing densities at time of smolt release, March 26, 1990.

Pond	Inflow	Millions of fish	Number per pound	Density index	Flow index
1	12.19 cfs	0.8	23.54	.12	1.35
2A	9.01 cfs	0.6	28.38	.24	1.27
2B	8.83 cfs	0.5	31.63	.19	0.96
2C	9.01 cfs	0.5	27.78	.21	1.00
2D	8.83 cfs	0.6	24.26	.24	1.43

IPC transport tankers planted 551,200 smolts in the Snake River directly below Hells Canyon Dam during March 20-22, 1990. All remaining Rapid River smolts were flushed from the rearing ponds directly into Rapid River on March 26, 1990. Plant size and number data is presented in Table 12.

Table 12. Smolt releases, Brood Year 1988.

Date	Plant site	Number planted	Number/pound
03/20/90	Below Hells Canyon Dam	111,100	27.8
03/20/90	Below Hells Canyon Dam	111,100	27.8
03/21/90	Below Hells Canyon Dam	113,900	31.6
03/21/90	Below Hells Canyon Dam	113,900	31.6
03/22/90	Below Hells Canyon Dam	101,200	31.6
Subtotal		551,200	
Little Salmon River			
03/20/90	Upriver .8 miles from mouth of Hazard Creek	125,000	27.8
03/20/90	Upriver .8 miles from mouth of Hazard Creek	125,000	27.8
Subtotal		250,000	
Rapid River			
03/12/90	Volitional Release	300,000	25.0
03/20/90 03/21/90	Remaining fish forced out of ponds.	546,700	23.5
03/26/90	Remaining fish forced out of ponds.	1,673,700	27.0
Subtotal		2,520,400	
Hatchery Total		3,321,600	

ACKNOWLEDGEMENTS

The crew at Rapid River Hatchery would like to thank Paul Abbott and the entire fisheries staff at IPC for their support and assistance in helping us improve the hatchery facility. We would also like to thank the staff from the IDFG hatcheries for helping us take eggs during the spawning season. We would also like to thank our local Conservation Officer, Eldon Anglen, for helping with enforcement problems at the hatchery and helping the hatchery personnel when high water conditions threatened the hatchery intake structure. We would also like to thank the Eagle Fish Health Lab pathology staff for doing disease diagnostic work at the hatchery and contributing some useful ideas that will help us reduce disease problems at the hatchery.

A P P E N D I C E S

Appendix 1. Returns of spring chinook salmon to Rapid River Hatchery, and enumeration of eggs, 1964-88.

Return year	Snake R. return (adults)	Rapid R. return (adults)	Rapid R. return (jacks)	Percent prespawn mortality	Females spawned	Eggs per female	Number of eggs taken
1964	349			16	182	4,874	887,000
1965	408			21	133	4,541	604,000
1966	1,511			18	621	3,697	2,296,000
1967	974	1,039	11	581	3,537	2,0	55,000
1968	351	3,416	740	2	1,809	3,671	6,540,000
1969	672	2,817	1,043	8	1,415	3,655	5,151,697
1970		6,470	887	10	3,520	4,136	14,560,280
1971		3,357	1,754	19	1,722	3,507	6,038,785
1972		12,310	943	15	3,825	3,941	15,072,604
1973		17,054	286	37	3,454	3,912	13,510,465
1974		3,457	538	27	1,756	3,924	6,890,186
1975		4,428	573	7	2,184	3,894	8,503,606
1976		6,342	1,765	15	3,055	3,762	11,492,878
1977		7,767	437	11	3,781	3,745	14,160,330
1978		5,735	34	21	2,350	4,266	10,026,888
1979		3,054	350	31	1,141	4,950	5,648,722
1980		1,528	432	30	543	3,235	1,756,827
1981		3,087	176	7	1,666	3,675	6,122,273
1982		3,646	30	11	1,883	3,973	7,482,330
1983		1,864	94	15	859	4,015	3,449,471
1984		1,705	651	7	821	3,807	3,125,911
1985		6,376	351	8	2,962	3,741	11,535,461*
1986		6,546	177	34	2,451	4,355	10,673,138*
1987		3,598	210	31	1,310	4,379	5,656,145*
1988		3,608	172	19	1,645	4,879	7,905,702*

* Includes eggs taken from Hells Canyon adults.

Appendix 2. Summary of spring chinook salmon returns to Rapid River by brood year.

Brood year	Year released	Number released	3 Year olds	Year returned	4 Year olds	Year returned	5 Year olds	Year returned	Total brood year return	% Return from plant
1964	1966	588,000	1,309	1967	3,422	1968	197	1969	4,658	0.80
1965	1967	479,267	740	1968	2,620	1969	874	1970	4,234	0.89
1966	1968	1,460,150	1,043	1969	5,596	1970	364	1971	7,003	0.48
1967	1969	900,192	887	1970	2,992	1971	1,544	1972	5,416	0.60
1968	1970	3,172,000	1,754	1971	10,766	1972	4,403	1973	16,923	0.53
1969	1971	2,718,720	943	1972	12,654	1973	1,759	1974	15,356	0.56
1970	1972	2,809,200	285	1973	1,698	1974	386	1975	2,370	0.08
1971	1973	2,908,425	53B	1974	4,206	1975	1,120	1976	5,864	0.20
1972	1974	2,707,917	573	1975	5,222	1976	634	1977	6,429	0.24
1973	1975	3,373,700	1,765	1976	7,110	1977	1,845	1978	10,720	0.32
1974	1976	3,358,940	437	1977	3,890	1978	2,413	1979	6,740	0.20
1975	1977	2,921,172	34	1978	598	1979	46	1980	678	0.02
1976	1978	2,413,678	350	1979	1,482	1980	146	1981	1,978	0.08
1977	1979	2,866,993	432	1980	3,068	1981	557	1982	4,057	0.14
1978	1980	2,604,823	176	1981	3,089	1982	1,206	1983	4,291	0.16
1979	1981	2,372,607	30	1982	838	1983	356	1984	1,224	0.05
1980	1982	1,473,733	94	1983	1,349	1984	199	1985	1,642	0.11
1981	1983	2,998,103	651	1984	6,177	1985	1,456	1986	8,284	0.28
1982	1984	3,246,197	351	1985	5,090	1986	1,155	1987	6,596	0.20
1983	1985	2,491,238	177	1986	2,444	1987	1,557	1988	4,178	0.17
1984	1986	1,594,688	210	1987	2,051	1988	379	1989	2,640	0.17
1985	1987	2,836,400	172	1988	1,933	1989	135	1990	2,300	0.08
1986	1988	2,630,200	428	1989	2,431	1990		1991		
1987	1989	2,319,500	40	1990		1991		1992		
1988	1990	2,520,400		1991		1992		1993		

Age determination by length frequency (see Appendix 6).

Appendix 3. Rapid River Hatchery feed use data for Brood Year 1988.

Feed size	Diet type	Pounds used
No. 2 Starter	BIODIET	1,408
No. 3 Starter	BIODIET	4,576
1.0 mm (1/32")	BIODIET	6,600
1.3 mm (3/64")	BIODIET	4,650
Ery Med	BIOMOIST	5,050
1.5 mm (1/16")	BIOMOIST	18,750
2.5 mm (3/32")	BIOMOIST	38,950
3.0 mm (1/8")	BIOMOIST	110,950
Ery Med	BIOMOIST	31,200
Hatchery Totals		222,134*

- This number represents the entire amount of feed purchased for Rapid River Hatchery brood year 1988 production and for stock reared at Rapid River Hatchery and outplanted as fingerling releases.

Appendix 4. Summary of eggs, fry, fingerlings, and smolts planted from Rapid River Hatchery 1964-89.

Brood Year	No. eggs taken	Egg, fry plants & site	Smolt plants & site		fish per pound
1964	887,000	None	588,000	Rapid R.	22.6
1965	604,000	None	479,267	Rapid R.	23.2
1966	2,296,000	None	1,460,150	Rapid R.	25.0
1967	2,055,000	None	900,192	Rapid R.	24.0
1968	6,540,000	757,376 eggs, Clearwater H Chan	3,172,000	Rapid R.	20.0
1969	5,171,697	497,000 eggs, Dworshak NFH to start Kooskia NFH.	2,718,720	Rapid R.	21.0
1970	14,560,280	4,417,454 eggs, Sweetwater Eye Stat.	2,809,200	Rapid R.	19.4
		2,224 eggs, Kooskia NFH	91,800	Lochsa R.	
		526,516 eggs, Hayden Ck. Hatchery			
		2,473,983 eggs, Clearwater H Chan			
		4,607,736 eggs, Rapid R. Hatchery			
		200,520 fry, Lemhi R.			
		353,970 fry, Decker Pond			
1971	6,038,785	600,000 eggs, Hayden Ck. Hatchery	197,303	SF Clear.	
		53,562 fry, Lemhi R.	2,908,425	Rapid R.	17.0
		104,300 fry, Red R.			
		29,800 fry, Ten Mi. Ck.			
		44,700 fry, American R.			
		14,900 fry, Papoose Ck.			
		59,600 fry, Brushy Ck.			
		44,700 fry, Fish Ck.			
		14,900 fry, Post Office Ck.			
		44,700 fry, Squaw Ck.(Lochsa)			
		61,500 fry, Lochsa R.			
1972	15,072,604	5,256,662 eggs, Sweetwater Eye Stat. 3,012,358 eggs, Hayden Ck. Hatchery 1,293,592 eggs, Red R. H Chan 4,878,017 eggs, Rapid R. Hatchery	2,707,917	Rapid R.	17.5
1973	13,510,464	3,915,900 eggs, Sweetwater Eye Stat.	117,000	SF Clearw	
		1,295,424 eggs, Hayden Ck. Hatchery	3,373,700	Rapid R.	14.8
		104,760 eggs, Hagerman Hatchery			
		502,200 eggs, Crooked R. H Chan			
		702,000 eggs, Kooskia NFH			
		806,400 eggs, Hayden Ck. Hatchery			
		504,000 eggs, Minnesota-walleye trade			
		210,734 fry, Sandpoint Hatchery			
		206,360 fry, Kooskia Hatchery			
		88,480 fry, Ten Mi. Ck.			
		18,200 fry, Newsome Ck.			
		633,000 fry, Lemhi R.			
		10,428 fry. Capehorn Ck.			

Appendix 4. (continued)

Brood year	No. eggs taken	Egg, fry plants & site	Smolt plants & site		fish pound
1974	6,890,186	809,400 eggs, Hayden Ck. Hatchery	205,700	SF Clearw	
		407,012 eggs, Indian Ck.	3,358,940	Rapid R.	18.4
		5,203,273 eggs, Rapid R.Hatchery 203,500 fry, Sandpoint Hatchery 21,840 fry, Capehorn Ck. 59,962 fry, Red R. 30,750 fry, Newsome Ck. 10,250 fry, Ten Mi. Ck. 1,140,300 fry, Lemhi R.			
1975	8,503,606	2,363,200 eggs, Sweetwater Eye Stat.	249,750	SF Clearw	
		252,200 eggs, Mullan Hatchery	2,921,172	Rapid R.	15.9
		255,000 eggs, Hayden Ck. Hatchery 280,659 eggs, Indian Ck. H Chan			
		4,906,492 eggs, Rapid R. Hatchery 34,000 fry, Ten Mi. Ck. 156,000 fry, Lemhi R. 65,960 fry, SF Clearwater R. 412,800 fry, Decker Pond 209,950 fry, Sandpoint Hatchery 36,143 fry, Bear Valley Ck.			
1976	11,492,878	1,161,608 eggs, Mullan Hatchery	2,413,678	Rapid R.	15.7
		2,937,994 eggs, Sweetwater Eye Stat. 261,900 eggs, Hayden Ck. Hatchery 261,900 eggs, Sandpoint Hatchery			
		1,267,208 eggs, Mackay Hatchery 5,009,482 eggs, Rapid R. Hatchery			
		47,008 fry, Univ of Idaho, Fish Coop. 311,850 fry, Mackay Hatchery 104,500 fry, Lolo Ck. 501,600 fry, Red R. Pond 80,600 fry, SF Clearwater R.			
1977	14,160,3	2,633,400 eggs, Sweetwater Eye Stat.	2,866,993	Rapid R.	15.0
		2,287,800 eggs, Kooskia NFH	156,362	White Sand	
		2,689,000 eggs, Mullan Hatchery	44,373	Newsome Ck.	
		288,000 eggs, Hayden Ck. Hatchery 20,700 eggs, Univ of Idaho			
		1,007,340 eggs, Crooked R. H Chan 5,098,587 eggs, Rapid R. Hatchery			
		723,000 fry, Mackay Hatchery 50,800 fry, Decker Pond 200,025 fry, Red R. Pond 265,600 fry, Lemhi R.			
1978	10,026,888	767,322 eggs, Hayden Ck. Hatchery	57,440	White Sand	
		970,728 eggs, Mackay Hatchery	2,604,823	Rapid R.	15.0
		1,540,282 eggs, Sweetwater Eye Stat. 706,936 eggs, Dworshak NFH 38,160 eggs, Univ of Idaho 10,864 eggs, Univ of Idaho (Hayden Ck.)			
		1,250,010 eggs, Crooked R. H Chan			
		249,969 eggs, Sweetwater Eye Stat. 232,500 fry, Red R. Pond 10,000 fry, Ten Mi. Ck.			

Appendix 4. (continued)

Brood year	No. eggs taken	Egg, fry plants & site	Smolt plants & site		fish per pound
1979	5,646,722	806,400 eggs, Hayden Ck. Hatchery	1,001,700	Snake R.	21.0
		330,880 eggs, Dworshak NFH	2,372,607	Rapid R.	17.9
		293,249 fry, Red R. Pond			
1980	1,756,827	None	1,473,733	Rapid R.	28.0
1981	6,122,273	608,384 eggs, Pahsimeroi Hatchery	250,020	Snake R.	27.0
		256,608 eggs, Oxbow Hatchery	2,998,103	Rapid R.	22.0
		449,280 eggs, Dworshak NFH			
		4,409,036 eggs, Rapid R. Hatchery			
1982	7,420,450	493,346 eggs, Looking Glass (OR)	500,850	Snake R.	27.0
		1,332,000 eggs, Pahsimeroi Hatchery	3,246,197	Rapid R.	20.0
		375,028 eggs, Dworshak NFH			
		125,055 eggs, Hagerman NFH			
		4,614,863 eggs, Rapid R. Hatchery			
		306,000 fry, Red R. Pond			
1983	3,449,471	None	437,360	Snake R.	27.0
			2,491,238	Rapid R.	23.0
1984	3,125,911(RR)	152,000 fry, Red R.	140,000	Snake R.	20.0
	217,181(Red R)		136,800	Red R.	30.0
			1,594,688	Rapid R.	22.0
1985	11,535,461	497,520 eggs, Oregon	103,000	Snake R.	31.1
		3,668,000 eggs, Dworshak NFH	2,836,400	Rapid R.	22.5
		2,450,907 eggs, Sawtooth Hatchery			
		100,590 fry, Boulder Ck.			
		349,650 fry, Crooked R.			
		200,158 fry, Eldorado Ck.			
		55,123 fry, Hopeful Ck.			
		144,443 fry, Crooked Fk.			
		70,282 fry, White Sands Ck.			
		49,437 fry, Ten Mi. Ck.			
		102,282 fry, Newsome Ck.			
		115,352 fry, Brushy Fk.			
1986	10,673,138	2,368,400 eggs, Dworshak NFH	400,600	Snake R.	19.8
		712,905 eggs, Sawtooth Hatchery	2,630,200	Rapid R.	19.2
		7,591,833 eggs, Rapid R. Hatchery			
		348,600 fry, Crooked Fk.			
		202,400 fry, White Sand Ck.			
		98,000 fry, Big Flat Ck.			
		238,900 fry, Red R. Pond			
1987	5,656,145	30,000 fry, Little Salmon R.	500,000	Snake R.	20.0
		103,800 fry, Lolo Ck.	2,319,500	Rapid R.	22.0
		53,200 fry, El Dorado Ck.			
		137,800 fry, Crooked Fk. Ck.			
		62,200 fry, Hopeful Ck.			
		108,300 fry, White Sand Ck.			
		72,200 fry, Big Flat Ck.			
		19,500 fry, White Sand Ck.			
		113,800 fry, American R.			
		112,100 fry, Newsome Ck.			
		100,100 fry, Meadow Ck.			
		200,100 fry, Crooked R.			
		50,100 fry, Red R.			
		50,100 fry, Yankee Fk.			
		202,000 fry, Brushy Fk.			
		150,100 fry, Ten Mi. Ck.			
		100,200 fry, White Sand Ck.			

Appendix 4. (continued)

Brood year	No. eggs taken	Egg, fry plants & site			Smolt plants & site		fish pound
1988	7,881,379	1,475,677	eggs,	Oregon F&G	551,200	Snake R.	30.0
		149,570	fry,	Little R.	250,000	L. Salmon	27.8
		100,278	fry,	10 Mi. Ck.	2,520,400	Rapid R.	26.0
		149,570	fry,	Little R.			
		100,278	fry,	10 Mi. Ck.			
		101,062	fry,	Crooked R.			
		100,862	fry,	Crooked R.			
		100,628	fry,	Newsome Ck.			
1988		100,299	fry,	Boulder Ck.			
		100,342	fry,	Boulder Ck.			
		100,097	fry,	Newsome Ck.			
		195,398	fry,	Brushy Fk.			
		99,919	fry,	White Sands Ck.			
		100,148	fry,	White Sands Ck.			
		99,401	fry,	American R.			
		51,369	fry,	American R.			
		39,163	fry,	Meadow Ck.			

Appendix 5. Run timing of spring chinook salmon returns to Rapid River, 1988.

Date		Numbers of fish		% Of total run
May	1- 7	0		0.00
	8-15	91		2.41
	16-22	221		5.85
	24-31	185		4.89
June	1- 7	652		17.25
	8-15	1,499		39.66
	16-23	818		21.64
	24-30	172		4.55
July	1- 7	116		3.07
	8-15	15		0.39
	16-23	5		0.13
	24-31	4		0.11
August	1- 7	0		0.00
	8-15	2		0.05
		3,780	Run Total	100.00

Appendix 6. Fork length data for the 1988 Rapid River spring chinook salmon run.

Fork length (cm.)	Number of fish
Less than 40	3
40	5
41	9
42	9
43	26
44	19
45	22
46	23
47	16
48	18
49	9
50	7
51	10
52	4
53	4
54	4
55	1
56	1
57	2
58	2
59	2
60	1
61	9
62	6
63	7
64	14
65	27
66	50
67	62
68	70
69	129
70	141
71	213
72	173
73	92
74	203
75	123
76	189
77	87
78	52
79	123
80	97
81	167
82	129
83	97
84	206
85	192
86	231
87	105
88	162
89	167
90	110
91	192
92	27
93 and greater	324
Run Total	4,173

Sex Composition Data

184	Jacks
1,745	Adult Males
2244	Females
4,173	Run Total

Chinook Salmon Age Class Data

184	Three year olds
1,880	Four year olds
2,109	Five year olds
4,173	Run Total

Age Determination Structure

0-53 cm = Three year olds
54-80 cm = Four year olds
81- > cm = Five year olds

Appendix 7. Fork length data for the 1988 Rapid River summer chinook salmon run.

Fork length (cm.)	Number of fish	Fork length (cm.)	Number of fish
40	1	80	3
41	0	81	5
42	0	82	5
43	0	83	2
44	1	84	8
45	1	85	7
46	4	86	6
47	0	87	5
48	2	88	6
49	1	89	6
50	0	90	8
51	3	91	0
52	0	92	8
53	0		
54	0	Run Total	115
55	0		
56	0		
57	0		
58	0	Sex Composition Data	
59	1		
60	0	13 Jacks	
61	0	49 Adult males	
62	0	53 Females	
63	0		
64	1	115 Run Total	
65	2		
66	2		
67	0		
68	2		
69	2		
70	3		
71	3		
72	4		
73	1		
74	2		
75	2		
76	3		
77	1		
78	2		
79	2		

Appendix 8. Feed and growth information based on data for spring chinook salmon at Rapid River Hatchery, 1980-89.

Month	Avg.water temp. (F)	Density index	Flow index	Feed cony	Hatchery constant	Avg.daily leng.inc.	Monthly leng.inc.	Condition factor	% Body no. wt. fed	Feedings per day	Average no. per lb. at end of month	Average length at end of month
February	38	N/A	N/A	3.00	1.98	0.0022	0.07	0.00026	1.42	8	1,084	1.53
March	41	0.25	0.54	1.30	2.85	0.0073	0.22	0.00028	1.89	8	847	1.62
April	44	0.28	0.50	1.00	3.50	0.0117	0.35	0.00030	2.40	8	461	1.93
May*	46	0.28	0.68	2.00	4.80	0.0080	0.24	0.00032	2.30	8	293	2.25
June	48	0.07	0.76	1.19	7.50	0.0210	0.63	0.00033	2.93	4	141	2.87
July	53	0.09	0.87	1.56	7.49	0.0160	0.48	0.00033	2.75	4	79	3.48
August	54	0.12	1.39	1.61	8.21	0.0170	0.51	0.00035	2.70	5	49	3.88
September	50	0.14	1.60	1.55	9.00	0.0170	0.51	0.00035	2.00	5	36	4.30
October	46	0.16	1.64	2.17	6.05	0.0093	0.28	0.00035	1.37	3	30	4.57
November	41	0.17	1.87	3.71	1.89	0.0017	0.05	0.00035	0.41	2	29	4.62
December	38	0.16	1.90	4.50	0.95	0.0007	0.00	0.00035	0.21	1	30	4.57
January	37	0.18	1.95	4.50	0.95	0.0007	0.00	0.00035	0.21	1	30	4.57
February	38	0.18	2.10	2.50	2.48	0.0033	0.10	0.00032	0.53	2	27	4.87
March	41	0.19	1.95	1.80	4.48	0.0083	0.25	0.00032	0.92	2	23	5.14

* Growth data may vary during periods of high water.

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